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Dichtyuchus, and *Aplanes* in form, manner of discharge, and germination of spores. A common type of variation is one in which chains of rounded sporangia discharging laterally are formed. It is well to have these variations recorded from observations on a single form in pure cultures.—H. HASSELBRING.

Photosynthesis in water plants.—BLACKMAN and SMITH²⁰ have published two papers upon "Gaseous exchanges of submerged plants," being nos. 8 and 9 of the excellent series on "Experimental researches on vegetable assimilation and respiration" issued from BLACKMAN's laboratory. The first of the present papers deals with "A new method for estimating the gaseous exchange in submerged plants." Instead of using the oxygen elimination as the basis for study, the CO₂ consumed is determined. Water of known CO₂ content (determined by titration) is passed over submerged plants of a given illuminated surface, and the CO₂ withdrawn for photosynthesis determined by later titration. Correction is made for CO₂ produced by respiration and for that in the eliminated gas. The method seems to insure reasonable accuracy.

In agreement with other workers, BLACKMAN and SMITH find *Elodea* extremely sensitive to adverse conditions. A few days of storage in tap water in laboratory or greenhouse cuts the assimilation 17 to 30 per cent. The plant also endures great concentration of CO₂. Water saturated from an atmosphere containing 30 per cent CO₂ does not interfere with assimilation; it is not likely that air plants would long endure such concentrations. The points of large significance can be set forth by quotations from the summary of the second paper:

"The aim of this study is to demonstrate the *nature* of the relation between assimilation and the chief environmental factors: (1) CO₂-supply, (2) light-intensity, and (3) temperature. The relation is such that the magnitude of this function in every combination of these factors is determined by one or the other acting as a limiting factor."

"The identification of the particular limiting factor in any definite case is carried out by applying experimentally the following general principle. When the magnitude of a function is limited by one of a set of possible factors, increase of that factor, and of that one alone, will be found to bring about an increase of the magnitude of the function."

"The experiments in this paper deal with such moderate intensities of assimilation as may be fairly well maintained for several successive hours. With more intense assimilation the values soon fall off by the action of internal factors grouped at present as the *time factor*. Experiments in which this additional factor has to be reckoned with will be considered in a later paper."

²⁰ BLACKMAN, F. F., and SMITH, A. M., Experimental researches on vegetable assimilation and respiration: VIII. A new method for estimating the gaseous exchanges of submerged plants; IX. On assimilation in submerged water plants and its relation to the concentration of carbon dioxide and other factors. Proc. Roy. Soc. London B 83:374-412. 1911.

The work from BLACKMAN's laboratory has done much to substitute a physico-chemical conception for the too general stimulus conception of the German plant physiologists. In this direction these papers again bring forth evidence for the non-existence of true optima, for the great importance of "limiting factors," and for the significance of what BLACKMAN has designated as the "time factor."—WILLIAM CROCKER.

Cytology of the ascus.—The controversy to which the behavior of the ascus nucleus has recently given rise, has led GUILLIERMOND²¹ to reinvestigate the subject. Contrary to the results of Miss FRASER^{22, 23, 24} and her coworkers, these new observations extend and entirely confirm his previous studies, and convince him that the number of chromosomes remains constant during the three successive mitoses of the ascus nucleus. He discusses the method of formation and the separation of the chromosomes of the first division, and whether there exists a second numerical reduction during the third nuclear division. In all of the species studied (*Humaria rutilans*, *Peziza catinus*, *Pustularia vesiculosa*, *Galactinia succosa*), he finds that the number of chromosomes of the equatorial plate stage and of the anaphases remains the same, and that the distribution of these chromosomes is accomplished in the same way in all of these forms. As in previous studies, GUILLIERMOND^{25, 26} believes that the process described by MAIRE^{27, 28} that is, a double longitudinal division of the chromosomes during the anaphases, which results in doubling the number of chromosomes found in the equatorial plate stage, rests on incorrect observations. He also believes that MAIRE's contention that there exists in the ascus of *Galactinia succosa* protochromosomes, which fuse into four definite chromosomes, is untenable. GUILLIERMOND holds that there are eight definite chromosomes and not four, which are formed directly and not from protochromosomes. These eight chromosomes are divided only during the meta-

²¹ GUILLIERMOND, M. A., Aperçu sur l'évolution nucléaire des ascomycètes et nouvelles observations sur les mitoses des asques. Rev. Gén. Botanique **23**:89-120. 1910.

²² FRASER, H. C. I., Contributions to the cytology of *Humaria rutilans*. Ann. Botany **22**:35-55. 1908.

²³ FRASER, H. C. I., and WELSFORD, E. J., Further contributions to the cytology of the ascomycetes. Ann. Botany **22**:465-477. 1908.

²⁴ FRASER, H. C. I., and BROOKS, W. E. St. J., Further studies on the cytology of the ascus. Ann. Botany **23**:538-549. 1909.

²⁵ GUILLIERMOND, M. A., Recherches sur la karyokinèse des ascomycètes. Rev. Gén. Botanique **16**:1-65. 1904.

²⁶ ———, Remarques sur la karyokinèse des ascomycètes. Ann. Mycol. **3**:344-361. 1905.

²⁷ MAIRE, R., Recherches cytologiques sur quelques ascomycètes. Ann. Mycol. **3**:123-154. 1905.

²⁸ ———, Recherches sur la karyokinèse chez les ascomycètes. Rev. Gén. Botanique **16**:130-143. 1904.